# ABSORPTION OF X RAYS BY COPPER AND URANIUM

BY

RALPH WILLIAM DRESSEL

B.S., Union College, 1944

## AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN PHYSICS
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1950

URBANA, ILLINOIS

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## ABSORPTION OF X RAYS BY COPPER AND URANIUM

X ray absorption cross sections of copper and uranium have been measured throughout the energy interval from 10 to 21 MeV using X rays from the 22 MeV betatron. The deuterium D $(\gamma,n)p$ reaction was used for a spectrum-analyzing detector. Disintegration protons were caught in accurately positioned photographic emulsions. The number of tracks recorded per unit area of the plate is a linear measure of the X ray intensity while the proton range is a measure of the X ray energy. Errors due to secondary radiation generated within the absorber have been reduced to negligible values by suitable geometric design. Experimental results have been compared with the sum of the theoretical cross sections for the photoelectric effect, Compton scattering, and pair production. The agreement for copper is within the experimental error of 4 per cent, but for uranium the theoretical values are from 12 to 22 per cent higher than the measured cross sections. This discrepancy, which far exceeds the experimental error of 2 per cent, is probably the result of the expected failure of the Born approximation used in the Bethe-Heitler calculation of the pair cross section. These results are consistent with those obtained by Adams at 11.04, 13.75, and 19.10 MeV, by Walker at 17.6 MeV, and by Lawson at 88 MeV.

## VITA

Ralph William Dressel was born on March 3, 1922, in Buffalo, New York. In 1932 he moved with his parents to Batavia, New York. There he attended the Batavia High School from which he was gradated in 1940. In September of that same year, he entered Union College where he held a scholarship for the full four year term. He was awarded the Turnbul Prize in Physics in 1941, and in 1942 he was granted an appointment as assistant instructor in physics, which he held until he received the degree of Bachelor of Science in 1944. Immediately upon graduating, he joined the staff of the M.I.T. Radiation Laboratory where he worked on the development and design of radar components for the duration of the war. Before terminating his association with the Laboratory, he contributed Chapters 8 and 12 in Book 22 of *The M.I.T. Radiation Laboratory Technical Series.* In March, 1946, he entered the Graduate College of the University of Illinois and held a half-time Research Assistantship until June, 1949. At that time he was awarded an Atomic Energy Commission Predoctoral Fellowship which extended to September, 1950. He is a member of The Society of the Sigma Xi, and also a member of The American Physical Society.